

METHODS

Objectives

The objective of the PMWHR assessment is to provide the BLM, USFS, and NPS with a detailed comprehensive inventory of rangeland condition, trend, and health in order to assess the overall health of the PMWHR soil and vegetative resources. In addition, NRCS is to provide a management recommendation as to the range in number of feral horses the PMWHR could support without causing deterioration to their habitat.

Summary of Methods

This inventory was conducted using NRCS methodology for performing Production and Species Composition, Similarity Index, Rangeland Health, and Apparent Ecological Trend, in accordance with the NRCS National Range and Pasture Handbook, 1997.

Ecological sites were identified and mapped in 1981 and provided the baseline for the inventory (BLM and SCS 1981). A copy of this inventory is on file at the Billings BLM field office. Thirteen new Ecological Site descriptions were developed to adequately address the complex and unique ecological nature of the area (Appendix A, page 77). Exclosures on the PMWHR and areas excluded from grazing near the PMWHR, such as Horseshoe Bend, were evaluated to provide a basis for the Historic Climax Plant Communities (HCPCs) described in the ecological site descriptions (Figure 3, page 48; Appendices B-E, page 79-85; and Appendix L, page 98). Horseshoe Bend is estimated to have been excluded from significant horse and cattle grazing since approximately 1967 (Padden 2002 personal communication).

On average, three transects were installed per section to evaluate similarity index, apparent ecological trend, species composition by weight, noxious weed cover, biologic crust cover, plant community type, and available forage production (Figure 4, page 49). Each transect location was identified with universal transverse mercator coordinates using a global positioning system unit (GPS). A visual appraisal of soil erosion was done at each transect and recorded if erosion was readily apparent. In addition, one rangeland health assessment was done per section at one of the transect locations. This included measuring a 100-point basal and canopy cover transect.

Transect locations within an inventory unit were generally selected based on the percent composition of a particular ecological site within the site complex itself, and the section as a whole. Once the general location was determined, the transect was placed in a stratified random fashion making sure it remained on one ecological site. Generally, ten 9.6 sq. ft. or ten 4.8 sq. ft. circular frames were placed at either 10-foot or 20-foot intervals along a 100-foot or 200-foot tape. A soil pit was also dug at most transect locations to verify the ecological site.

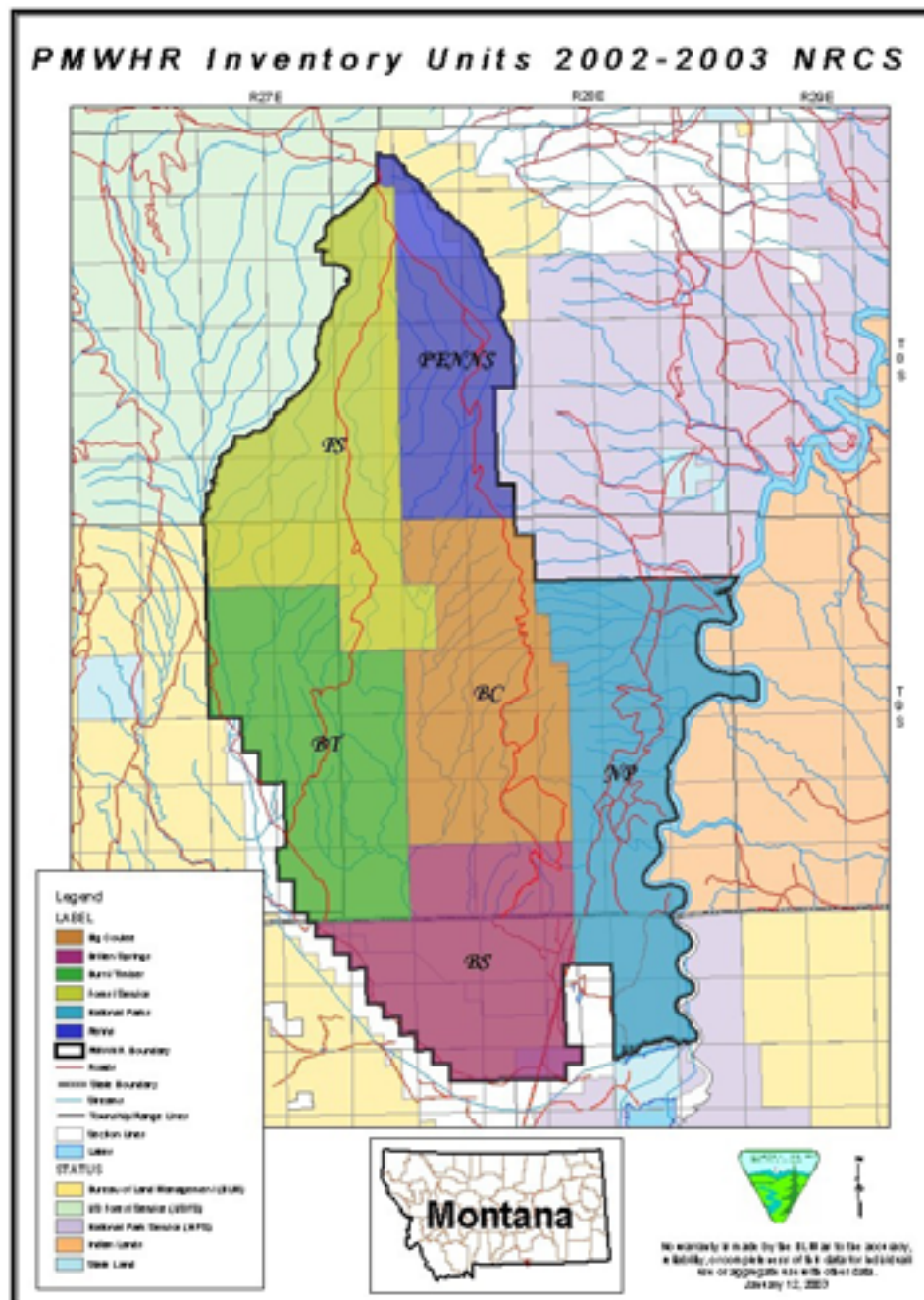
A detailed description of the inventory procedures is described in the “Summary of Rangeland Inventory Procedures” (Appendix M, page 99). For curl-leaf mountain mahogany (*Cercocarpus ledifolius*) and Utah juniper (*Juniperus osteosperma*) we did not clip current year’s growth, but rather used indirect measurements utilizing the NRCS zigzag transect methodology (Ricketts 1992 unpublished data, NRCS National Range and Pasture Handbook 1997).

The inventory data was recorded on topographical maps and entered into a geographical information system (GIS) format.

The large ungulate populations were inventoried for numbers, along with an evaluation of forage requirements and potential dietary overlap.

Inventory Units

The PMWHR was divided into six inventory units (Figure 1, page 46) for survey management purposes. The units are Forest Service (FS), Penn's Cabin (Penn's), Burnt Timber (BT), Big Coulee (BC), National Park (NP), and Britton Springs (BS). The inventory units were not necessarily divided according to administrative ownership, but rather according to road accessibility, similar topography, and unit size. The remainder of this report will refer to these inventory units.





Looking north across the Burnt Timber inventory unit.



Penn's cabin.



Looking north across the sub alpine meadows at the north end of the Penn's Cabin inventory unit.



Looking across the Big Coulee to the forested south end of the Penn's Cabin inventory unit.



Looking from the road to Britton Springs at the Big Coulee inventory unit below Sykes ridge.

Ecological Sites

An ecological site is a distinct kind of land that differs from other ecological sites in its ability to produce a certain kind and amount of vegetation. There are four major factors that differentiate an ecological site: topography/geology, climate, soils, and vegetation.

The topographical / geological area is described using rangeland resource units (RRUs). The PMWHR can be divided into two RRUs, as described in the Montana Field Office Technical Guide (NRCS 1993). They are the desertic basins and the Northern Rocky Mountains, south.

The desertic basins are areas typically receiving less than 10 inches of MAP and producing predominantly a sagebrush / salt-shrub plant community, and are interior to the mountains at relatively high altitudes. In Montana, this RRU occurs only in southern Carbon County, south of the towns of Bridger and Belfry near the Wyoming state line. This is the only area where Utah juniper exists in Montana, and is the northern most extent (McCarthy 1996). The desertic basins RRU occupies the lower sixth of the BT unit, most of the BS unit except for one and one half sections in the northeast corner, and about a section in the southwest corner of the NP unit. The remainder of the PMWHR is a part of the Northern Rocky Mountains, south RRU.

The Northern Rocky Mountains, south RRU are areas where the soils are associated with the mountain geology and have formed in place. In general, slopes tend to be 20 percent or greater and MAP is 15 inches or more. On the PMWHR, the Madison limestone formation generally marks the beginning of this RRU and the MAP begins between nine to 10 inches, with one exception being the south end of the NP unit where MAP is slightly less. The “south” designation denotes a region of the Northern Rocky Mountains in Montana that produces a different historical climax plant community (HCPC) than other Northern Rocky Mountain regions in Montana. In the “south”, spike fescue (*Leucopoa kingii*) becomes a dominant grass in

the 15 inches+ MAP HCPC, while rough fescue (*Festuca scabrella*) is not a component of the HCPC.

Climate integrates a number of factors such as MAP, temperature, growing season, and Chinook frequency. Except for MAP, these factors are integrated into the RRUs. The MAP varies across the PMWHR. Utilizing information from BLM and USFS remote access weather stations (RAWS) located at Britton Springs (4,100 feet, 58N 95W Sec.19 NW), Pryor mountain (6,186 feet, 6S 26E Sec.3 NE), south Bridger (4,725 feet, 7S 24E Sec.20 SW), and a NPS weather station located at the Sorenson ranch, a mean annual precipitation (MAP) map was developed for the PMWHR (Figure 2, page 47).

The soil name of each ecological site is characterized in Appendix A. For example, a complete ecological site name would be “very-shallow-limy, Northern Rocky Mountains, South 10-14 inches MAP”. Described is the soil, RRU, and climate (MAP). In this study we used the MAP map which correlated to elevation to indicate what the MAP was at each transect location. The MAP was then used to adjust the HCPC production for that site.

In summary, vegetation kind and amount is a product of its environment. This is the reason a “very-shallow-limy” soil in Arizona does not produce the same kind and amount of vegetation as a “very-shallow-limy” soil in Montana. Different topography / geology and a different climate mean different vegetation, even on a similar soil.

List of Transects

A list of transects sampled for each inventory unit is located in Appendices F through K. The tables provide information for each transect including:

- ecological site name
- mean annual precipitation (MAP)
- soil map unit
- dominant plant community
- total annual production in dry weight pounds per acre
- annual forage production in dry weight pounds per acre
- initial stocking rate in animal unit months/acre (AUMs)
- similarity index rating
- apparent ecological trend
- vegetation and litter basal cover percent
- coarse fragment and bare ground percent

Similarity Index

Similarity index is a rating comparing the present plant species composition by weight to that of the historic climax plant community (HCPC), and is synonymous with range condition. The higher the similarity index rating, the closer the plant community is to the historic or reference plant community. Similarity index is a quantitative and repeatable measurement. In many ways it is a quantifiable index of health relative to the potential native plant community.

Ecological Trend

Ecological trend is defined as the direction of change in an existing plant community relative to the historic climax plant community. Data collected for this inventory is apparent trend, that is a point in time determination of the direction of change either towards (upward) or away (downward) from the historic community. If no change is detectable, the rating 'not apparent' is given.

Rangeland Health

The purpose of determining rangeland health is to provide information on the functioning of the ecological processes and the stability of the site. This information can then be used to better understand the integrity of the site and its potential to respond to treatment or management.

Rangeland health data was collected for one transect per section, and results are divided into three categories:

- A. Factors which mostly influence soils and site stability: rills, pedestalling, gullies, wind erosion, and soil surface
- B. Factors which influence the watershed and hydrologic cycle: water flow patterns, bare ground, infiltration and runoff, litter distribution, and litter amount
- C. Factors which influence plant community integrity: cryptobiotic crusts, plant mortality, plant functional groups, plant stress, production, invasive plants, and recruitment and reproduction

The ecological site description for each ecological site provides the basis of comparison for rangeland health ratings (refer to BLM and SCS 1981 and Appendices B-E, pages 79-85). All seventeen attributes were rated using a numerical score one through five, with one being the lowest condition and five being the highest condition. A copy of the rangeland health indicator evaluation matrix appears in Appendix N (page 105).

Worksheet scores of four to five are considered healthy, with attributes closely resembling those of the historic climax plant community. Scores of 2.6 to 3.9 are considered at risk for site deterioration, and may be vulnerable to additional disturbances, such as strong climatic events, or excessive grazing pressure. Scores of 2.5 or less are unhealthy, and reflect attributes within the plant community which may not be able to recover from degradation without energy input, such as mechanical alteration.

Forage Value Rating

Forage value rating is a classification indicating the grazing value of important plant species for specific types of livestock or wildlife (Appendices O and P). The classification is based on the preference of the animal for a plant species, in relation to other available plants, and the relative abundance of the plant. Five forage categories are recognized:

- A. Preferred: plants which are highly palatable and sought out by animals
- B. Desirable: plants which are useful forage, but not highly preferred

- C. Undesirable: plants which are basically unpalatable and rarely consumed
- D. Nonconsumed: plants which are never consumed
- E. Toxic: plants which are poisonous to animals if ingested

Initial Stocking Rates

The best method to determine whether or not current stocking rates are appropriate and are meeting resource objectives is by measured trend of the resource condition. In units where resource concerns are identified, an analysis of overall carrying capacity and animal requirements should be made to determine if livestock forage demand is balanced with available forage. On the PMWHR we evaluated total forage demand by feral horses, dietary overlap with Bighorn sheep and mule deer, forage availability, and forage grazability. Grazability is the percentage of usable forage in an area allocated for use in order to maintain plant health. It is a relative term considering animals' grazing preference of areas including variables such as distance from water, ecological sites, slope steepness, aspect, and species preference.

Total forage availability can be used to determine an initial stocking rate value, per ecological site by using the following equation:

$$\frac{\text{Total Available Forage (pounds per acre)} \times 30\% \text{ Harvest Efficiency for Preferred and Desirables and } 10\% \text{ Harvest Efficiency for Undesirables}}{93 \text{ air-dry pounds forage per Animal Unit Month (AUM)}} = \text{AUMs/Acre}$$

Example: Silty Range Site with 287 air-dry lbs/acre of preferred forage and 20 air-dry lbs/acre of undesirable forage (HE=Harvest Efficiency)

$$\frac{287 \text{ lbs/acre} \times 30\% \text{ HE} + (20 \text{ lbs/acre} \times 10\% \text{ HE})}{\text{lbs/AUM}} = .111 \text{ AUMs/Acre}$$

When using pounds of forage production to determine initial stocking rates, a range of numbers should be considered based on annual climatic fluctuations. It is best to look at a range from 20 percent below average precipitation to 20 percent above average precipitation. For example, 287 lbs/acre should be looked at as a range from 230 to 350 lbs/acre.

To determine a total carrying capacity for a unit, it must first be determined how livestock are grazing the unit, and if there are any areas which are not accessible due to distance from drinking water or steep slopes. These areas must be assigned a lower initial stocking rate if animals are not actually using them. Different ecological sites within a unit will have different productivity, and must be taken into account also. On the PMWHR we have mapped ecological sites, and modeled distance from water and slope steepness in order to make adjustments to available forage.

Feral Horse, Bighorn Sheep, and Mule Deer Inventory

The number and demographics of feral horses were obtained directly from the BLM. A literature search was conducted to evaluate the nutritional requirements of the horses. The numbers and nutritional requirements of bighorn sheep and mule deer were obtained from the United States

Geological Survey – Biological Research Division (USGS-BRD); Montana Fish, Wildlife, and Parks Department; and the Wyoming Game and Fish Department.

The potential for forage competition between feral horses, bighorn sheep, and mule deer was evaluated using studies by Kissell and others (1996) and the USGS-BRD (2004).



Sykes Ridge looking across the Bighorn Canyon to the Bighorn Mountains.